ANNUAL SUMMARY 1972
Issued October 1974

CENTER FOR DISEASE CONTROL

NEUROTROPIC DISEASES SURVEILLANCE

POLIOMYELITIS

TABLE OF CONTENTS

I. SUMMARY
II. EPIDEMIOLOGY OF PARALYTIC POLIOMYELITIS
III. LABORATORY STUDIES OF POLIOMYELITIS
IV. VACCINE DISTRIBUTION AND VACCINATION STATUS OF THE POPULATION
V. ADDENDUM — Additional Cases of Paralytic Poliomyelitis Reported for 1971

Appendix: Recommendations of the PHS Advisory Committee on Immunization Practices

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

PREFACE

Summarized in this report is information received from state health departments, university investigators, virology laboratories, and other pertinent sources, domestic and foreign. Much of the information is preliminary. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to this report are most welcome. Please address:

Center for Disease Control
Attn: Neurotropic Diseases
Viral Diseases Division
Bureau of Epidemiology
Atlanta, Georgia 30333

SUGGESTED CITATION

Center for Disease Control: Poliomyelitis Surveillance, Annual Summary 1972
Issued October 1974

Center for Disease Control . . . . . David J. Sencer, M.D., Director

Bureau of Epidemiology . . . . . Philip S. Brachman, M.D., Director

Viral Diseases Division . . . . . Michael B. Gregg, M.D., Director

Neurotropic Diseases . . . . . Paul D. Walter, M.D.
Lawrence B. Schonberger, M.D.*

Bureau of Laboratories . . . . . Roslyn Q. Robinson, Ph.D., Director

Virology Division . . . . . Walter R. Dowdle, Ph.D., Director

Enteric Virology Branch . . . . . Milford H. Hatch, Sc.D., Chief

Viral Examination Branch . . . . . James H. Nakano, Ph.D., Chief

*Until July 1973

I. SUMMARY

Twenty-two cases of paralytic poliomyelitis with 3 deaths were reported in the United States in 1972. This represents an increase of 3 cases from the corrected total of 19 cases reported for 1971. The cases were scattered among 14 states. Connecticut and New York with 4 cases each, and Texas with 3 cases, were the only states to report more than 1 case. Seventeen (78%) of the 22 cases were in persons 19 years of age or younger, and 5 (23%) were in preschool age children. Type 1 poliovirus was implicated in 64% of the cases, and in 74% of those cases in which an etiology was determined. Four of the 22 reported cases were "recipient vaccine-associated" and 6 were "contact vaccine-associated." Two additional cases of paralytic poliomyelitis were reported for 1971 and were both "contact vaccine-associated," increasing the 1971 total to 19 cases, 10 of which were "contact vaccine-associated." This is the highest annual number of "contact vaccine-associated" cases reported to CDC since live, attenuated oral poliovirus vaccine became widely used in 1962. None of the persons who contracted paralytic poliomyelitis in 1972 gave a history of having received adequate polio immunization.

The 1972 National Immunization Survey showed a continuation of the downward trend in the percent of preschool age children who received at least 3 doses of either oral poliovaccine or inactivated poliovaccine. The general trend of a decreasing percentage of persons with adequate polio immunizations occurred in all age groups.

II. EPIDEMIOLOGY OF PARALYTIC POLIOMYELITIS

This 18th Annual Poliomyelitis Surveillance Report, published by Neurotropic Diseases, Viral Diseases Division, CDC, summarizes selected epidemiologic and laboratory characteristics of the reported cases of poliomyelitis for 1972. These data are based on official reports from the states to the Bureau of Epidemiology, CDC.

In 1972, the "best available paralytic poliomyelitis case count" was 22 cases. This terminology, used since 1958 as the best available representation of the number of cases of paralytic illness of poliovirus etiology, includes those clinically and epidemiologically compatible cases known to have residual paralysis at 60 days, plus those cases reported initially as paralytic poliomyelitis for which no 60-day report on residual paralysis was available. Limitation of the summary count to those cases with proved residual paralysis permits exclusion of cases with more transient weakness possibly due to echovirus, Coxsackie virus, or other etiologies. Twenty-one of the 22 paralytic cases reported for 1972 had pathologic, serologic, or virologic supporting evidence for the diagnosis of poliomyelitis. Follow-up reports from 1 to 6 months after onset of illness were submitted for the 19 surviving cases; residual paralysis was present in all 19 cases.

A. Characteristics of the Cases

The total number of cases included in the "best available paralytic poliomyelitis case count" has declined since this number was first tabulated in 1958 (Figure 1). The 22 cases reported in 1972 represents the third lowest annual total reported to CDC since initiation of surveillance in 1955. In 1972, cases occurred throughout the year, with 10 cases occurring in October (Figure 2); 8 of the 10 were clustered in 1 outbreak. The classic summer-fall peak, last observed in the early 1960s (Figure 3), has not persisted.

DHEW Publication No. (CDC) 75-8214

Fig. 1 "BEST AVAILABLE PARALYTIC POLIOMYELITIS CASE COUNT," BY YEAR, UNITED STATES, 1958-1972

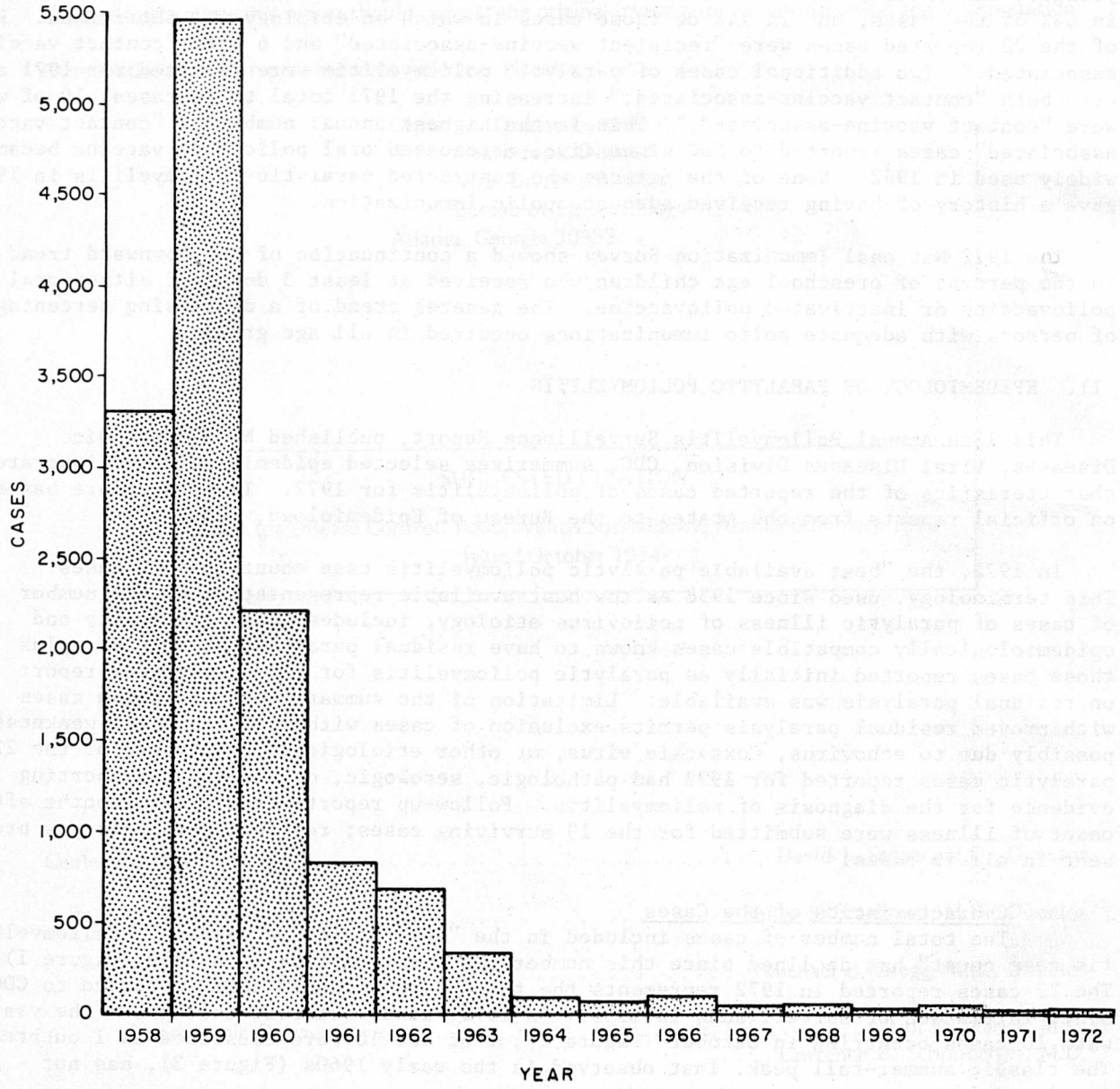


Fig. 2 PARALYTIC POLIOMYELITIS, BY ONSET, U.S.A., 1972

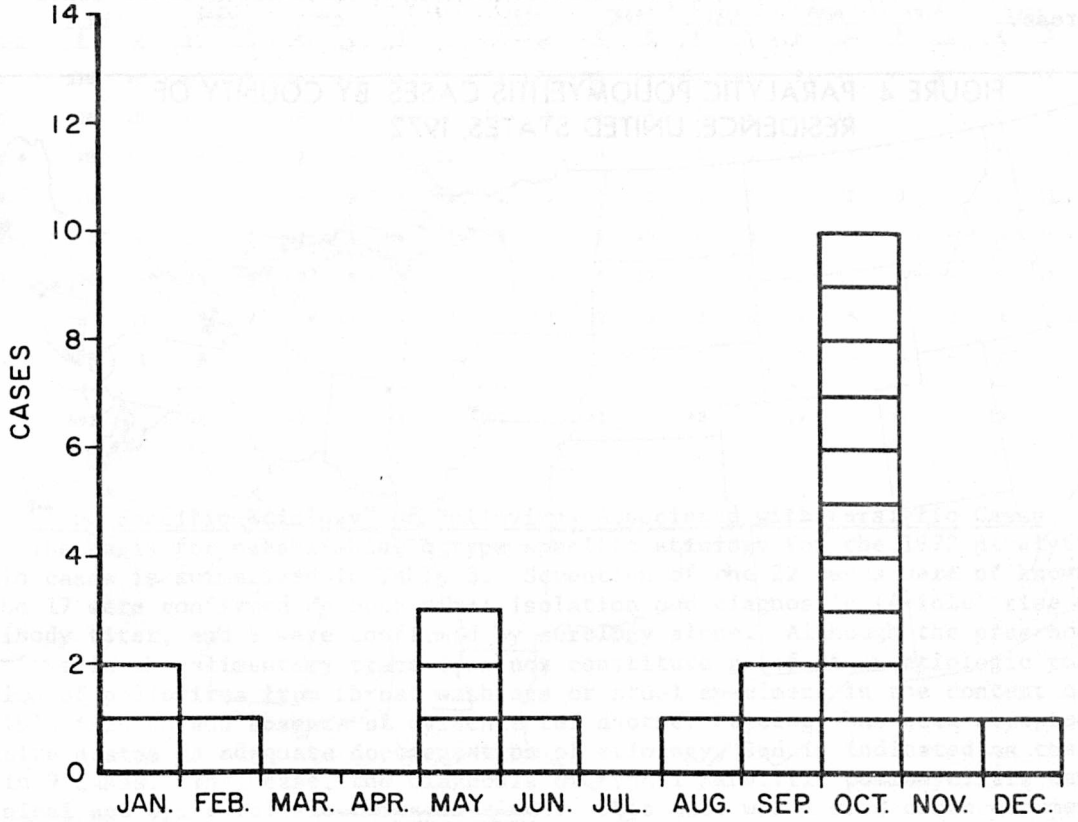
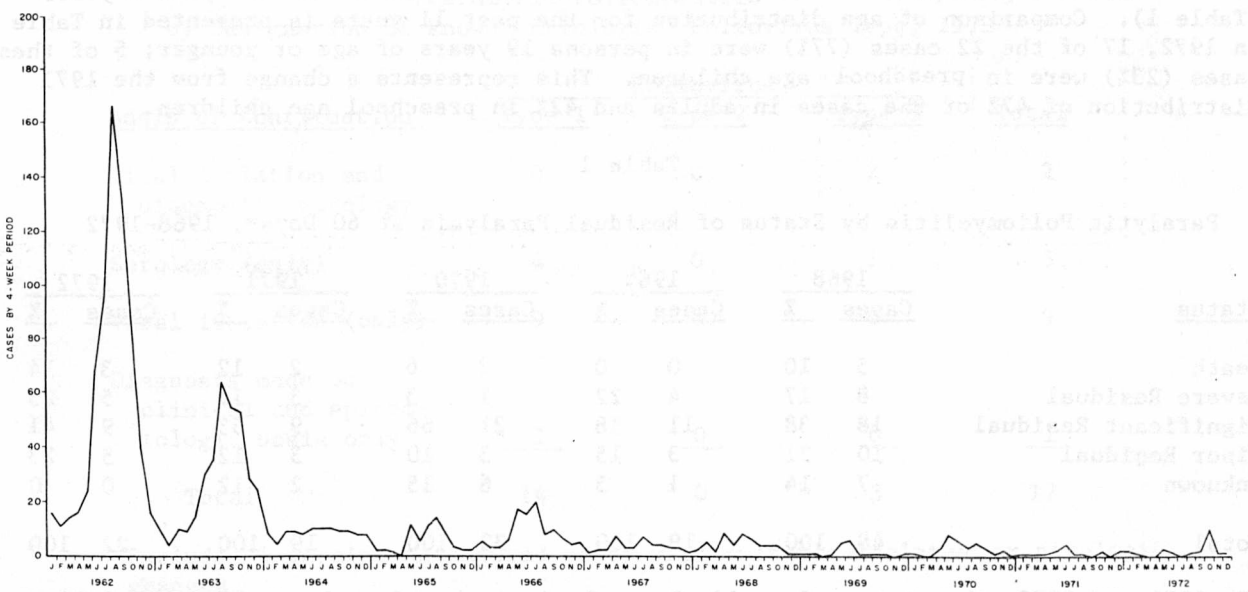
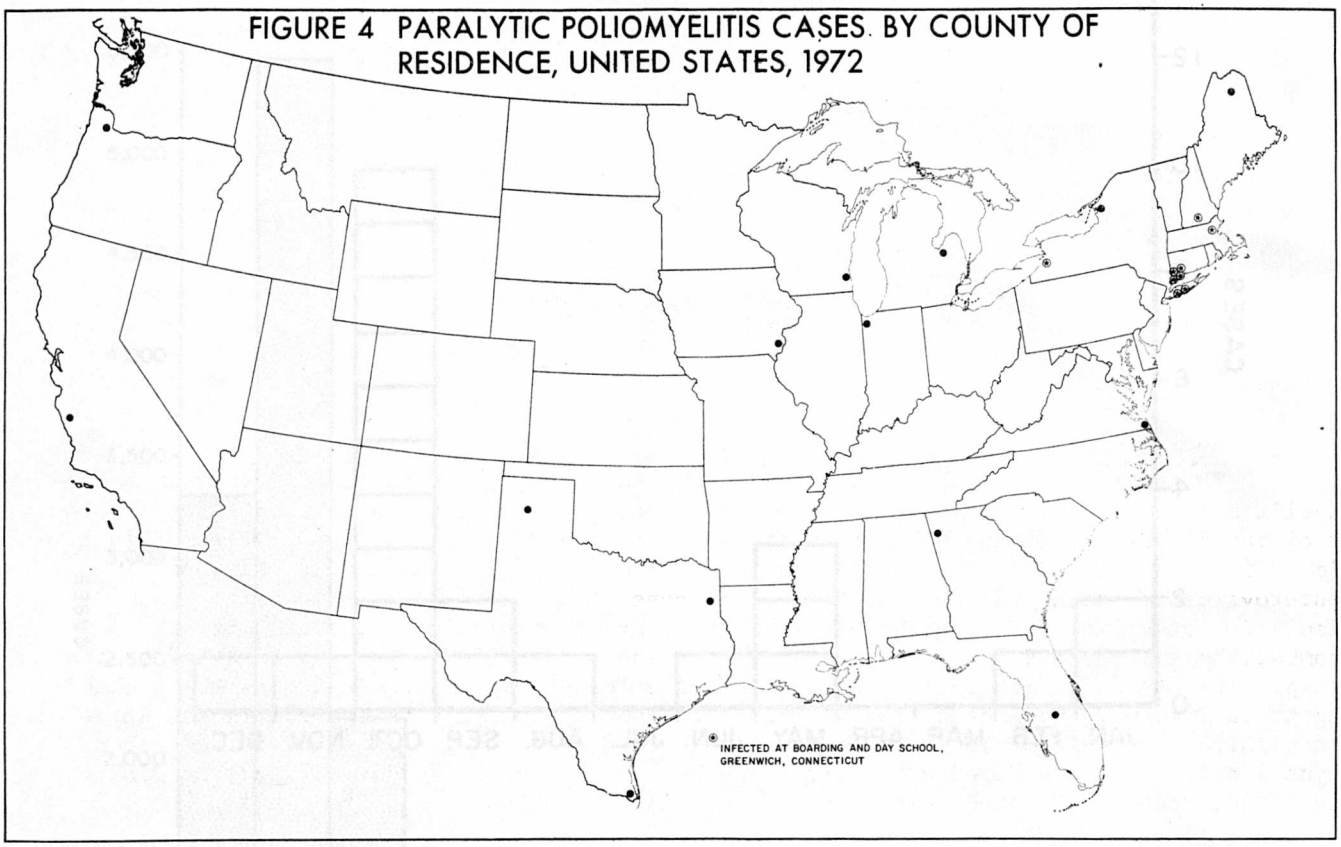


Fig. 3 PARALYTIC POLIOMYELITIS CASES, BY MONTH OF ONSET, UNITED STATES, 1962-1972



Geographic distribution of cases by county of residence (Figure 4) shows that cases were scattered among 14 states. Connecticut and New York with 4 cases each, and Texas with 3 cases, were the only states reporting more than 1 case. One case was temporally related to travel to Mexico. None of the other cases were related to known travel to endemic areas.

FIGURE 4 PARALYTIC POLIOMYELITIS CASES BY COUNTY OF RESIDENCE, UNITED STATES, 1972



Residual paralysis in the cases parallels that reported for the past 4 years (Table 1). Comparison of age distribution for the past 11 years is presented in Table 2. In 1972, 17 of the 22 cases (77%) were in persons 19 years of age or younger; 5 of these cases (23%) were in preschool age children. This represents a change from the 1971 distribution of 47% of the cases in adults and 42% in preschool age children.

Table 1

Paralytic Poliomyelitis by Status of Residual Paralysis at 60 Days*, 1968-1972

Status	1968		1969		1970		1971		1972	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Death	5	10	0	0	2	6	2	12	3	14
Severe Residual	8	17	4	22	1	3	3	12	5	23
Significant Residual	18	38	11	58	21	66	9	53	9	41
Minor Residual	10	21	3	15	3	10	3	12	5	23
Unknown	7	14	1	5	6	15	2	12	0	0
Total	48	100	19	100	33	100	19	100	22	100

*In 1971 and 1972, the status of residual paralysis is based on 1- to 11-month follow-up reports

Table 2

Paralytic Poliomyelitis Cases, by Age Group, 1962-1972

Age Group	1962		1963		1964		1965		1966		1967		1968		1969		1970		1971		1972	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0- 4	338	49	165	49	38	42	31	51	79	77	25	61	31	65	9	46	30	97	8	42	5	23
5- 9	139	20	60	18	16	17	10	16	10	10	2	5	3	6	2	11	2	6	0	-	1	5
10-14	70	10	38	11	7	8	7	11	3	3	0	-	4	9	1	5	0	-	0	-	3	14
15-19	26	4	15	4	8	9	2	3	1	1	1	2	1	2	4	22	0	-	2	11	8	36
20-29	52	8	24	7	7	4	4	7	3	3	4	10	4	8	0	-	0	-	3	16	1	5
30-39	36	5	18	5	7	8	3	5	5	5	7	17	2	4	2	11	0	-	5	26	3	14
40 +	22	3	8	2	11	12	4	7	1	1	2	5	3	6	1	5	1	3	1	5	1	5
Unknown	8	1	8	2	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Total	691		336		91		61		102		41		48		19		33		19		22	

B. "Type Specific Etiology" of Poliovirus Associated with Paralytic Cases

The basis for establishing a type specific etiology for the 1972 paralytic poliomyelitis cases is summarized in Table 3. Seventeen of the 22 cases were of known etiology; 2 of the 17 were confirmed by both viral isolation and diagnostic (4-fold) rise or fall in antibody titer, and 5 were confirmed by serology alone. Although the presence of an enterovirus in the alimentary tract does not constitute proof of an etiologic role, isolation of poliovirus from throat washings or stool specimens in the context of compatible illness and absence of evidence for another etiology has been accepted by the respective states as adequate documentation of etiology, and is indicated as the probable agent in 9 cases. In 1 case, the diagnosis of type 1 paralytic poliomyelitis was based on clinical and epidemiologic criteria alone. This case was 1 of 8 cases documented as type 1 poliovirus clustered at a boarding school in Connecticut, and a single serologic test indicated an elevated polio type 1 neutralizing antibody.

Table 3

Paralytic Poliomyelitis
by Designation of Known "Etiologic" Poliovirus Type, 1972*

Basis of Confirmation	Poliovirus Type 1	Type 2	Type 3	Total
Viral isolation and diagnostic serology	0	0	2	2
Serology (only)	4	0	1	5
Viral isolation (only)	9	0	0	9
Diagnosis made on clinical and epidemiologic basis only	1	0	0	1
Total	14	0	3	17

*Excludes 4 vaccine-associated cases with multiple isolates or serologic changes

Comparison of "etiologic" poliovirus types for 1966-1972 (the only years for which this method of definition has been used) shows that in 1972, type 1 poliovirus increased from the lowest level of 26% in 1971 to 64%, the second highest percentage since 1966. However, for the first time in 7 years, type 2 poliovirus was not implicated as the etiologic agent in any of the reported cases (Table 4).

Table 4

Paralytic Poliomyelitis Cases
by "Etiologic" Poliovirus Types, 1966-1972

	Poliovirus								Multiple* Types		
	Type 1		Type 2		Type 3		Unknown				
Year	#	%	#	%	#	%	#	%	#	%	Total Cases
1966	60	59	13	13	6	6	23	22	-	-	102
1967	18	44	8	19	7	18	8	19	-	-	41
1968	27	56	7	15	4	8	10	21	-	-	48
1969	6	32	5	26	4	21	4	21	-	-	19
1970	28	85	4	12	1	3	0	0	-	-	33
1971	5	26	6	32	6	32	2	11	-	-	19
1972	14	64	0	0	3	14	1	5	4	18	22

*Multiple types implicated by isolation and serology in vaccine-associated cases

Tabulation of the 22 paralytic cases by age group and "etiologic" virus type shows that 17 of the 22 cases (78%) were under 20 years of age (Table 5). Thirteen of the 17 (76%) had type 1 polio and 13 of the 22 (59%) were concentrated in the group of less than 20 years of age with type 1 polio. Eight of the 13 cases occurred in 1 outbreak.

Table 5

Paralytic Poliomyelitis Cases
by Age Group and "Etiologic" Poliovirus Type, 1972

	Poliovirus					
Age Group	Type 1	Type 2	Type 3	Multiple Types	Unknown	Total
0-4	3	0	0	2	0	5
5-19	10	0	0	2	0	12
20-29	0	0	1	0	0	1
30-39	0	0	2	0	1	3
40 +	1	0	0	0	0	1
Total	14	0	3	4	1	22

C. Viral Isolations Associated with Paralytic Poliomyelitis Cases

The number of cases in which viral isolations were attempted and the number in which isolation attempts were successful for the period 1961-1972 are shown in Table 6. Samples for viral isolation were obtained in a higher percentage of cases in 1970, 1971, and 1972, than in each of the previous 9 years. This probably reflects a continuing increased utilization of laboratory testing to confirm clinical impressions.

Table 6

Paralytic Poliomyelitis Cases by Number of Specimens Submitted and Results of Virus Isolation Attempts, by Year, 1961-1972

Year	Best Available Paralytic Case Count	Cases with Specimens Submitted for Isolation		Cases With Poliovirus Isolated		% of Specimens Submitted in Which Isolation Successful
		No.	%	No.	%	
1961	829	481	58.0	382	46.1	79%
1962	691	472	68.3	408	59.0	86%
1963	336	242	72.0	197	58.6	81%
1964	91	77	84.6	51	56.0	66%
1965	61	50	81.9	38	62.3	76%
1966	103	82	79.6	74	71.8	90%
1967	40	31	77.5	29	72.5	93%
1968	48	39	81.2	35	72.9	90%
1969	19	16	84.2	14	73.7	88%
1970	33	33	100.0	31	93.9	94%
1971	19	17	89.5	14	73.7	82%
1972	22	20	90.9	15	75.0	68%

Twenty of the 22 patients submitted specimens for poliovirus isolation. Specimens submitted from 19 of 20 included a stool specimen or rectal swab. An isolate was obtained from 13 of the 19 specimens. Four cases had positive throat cultures, and poliovirus was isolated from the brain of 1 fatal case. None of the 6 cerebrospinal fluid (CSF) samples was positive, and 1 of the 3 urine samples yielded an isolate. A comparison of the frequency of isolation of each poliovirus type from the annual total of paralytic cases for the years 1961-1972 is shown in Table 7.

Table 7

Paralytic Poliomyelitis Cases by Type of Poliovirus Isolated and Percentage of Isolates by Year, 1961-1972*

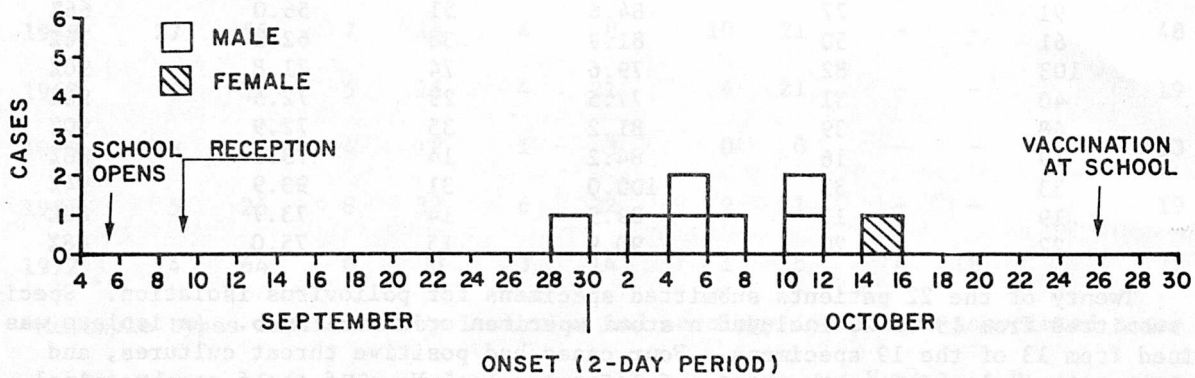
Year	Number of Isolates, Poliovirus Type				Percentage of Isolates, Poliovirus Type		
	1	2	3	Unknown	1	2	3
1961	231	6	145	0	60.5	1.6	37.9
1962	300	8	100	0	73.5	2.0	24.5
1963	160	6	31	0	81.2	3.0	15.7
1964	21	6	24	0	41.1	11.8	47.0
1965	19	8	11	1	50.0	21.1	28.9
1966	55	13	6	1	74.3	17.6	8.1
1967	16	6	7	0	55.2	20.7	24.1
1968	25	7	3	0	71.4	20.0	8.6
1969	5	5	4	0	34.6	34.6	30.8
1970	26	4	1	0	83.9	12.9	3.2
1971	5	4	5	0	35.7	28.6	35.7
1972	11[1,2]	1[1]	6[1,2]	0	61.1	5.5	33.3

*Includes vaccine-associated cases with multiple isolates
[1]Includes 1 case with isolates of all 3 types
[2]Includes 1 case with isolates of types 1 and 3

D. Epidemic of Poliomyelitis, Greenwich, Connecticut, 1972

From September 29 through October 18, 1972, 11 cases of poliomyelitis occurred in students attending a Christian Science boarding school in Greenwich, Connecticut (Figure 5). Eight of the 11 cases were paralytic and 3 were nonparalytic. None of the 8 students with paralytic poliomyelitis had been previously immunized with either inactivated polio vaccine (IPV) or oral poliovaccine (OPV); 1 of the 3 students with nonparalytic polio had received 2 IPV and all 3 types of monovalent oral poliovaccine (MOPV) 9 years previously. The age distribution among cases was from 7-18 years of age. Nine cases were in males and 2 in females. Residual at 60 days demonstrated severe paralysis in 2 cases. Isolates were obtained from 7 of the 11 cases, and all were compatible with wild virus origin. The 4 cases with no isolate had an elevated serologic titer to type 1 poliovirus.

Fig. 5 PARALYTIC POLIOMYELITIS CASES, DAYCROFT SCHOOL, GREENWICH CONN., 1972



This epidemic represents the potential for epidemics of poliomyelitis to occur in unimmunized populations.

E. Association of Immunization with Paralytic Poliomyelitis

1. Paralytic Poliomyelitis in Recent Vaccine Recipients

In July 1964, the Surgeon General's Special Advisory Committee on all poliomyelitis vaccine reviewed all cases of paralytic disease consistent with poliomyelitis that had occurred within 30 days following receipt of all OPV. At that time, 57 cases were judged to be compatible with vaccine association by virtue of meeting the following criteria:

a. Onset of illness between 4 and 30 days following feeding of the specific vaccine, plus onset of paralysis not sooner than 6 days after the feeding.

b. Significant residual lower motor neuron paralysis.

c. Laboratory data not inconsistent with respect to multiplication of the vaccine virus fed.

d. No evidence of other motor neuron disease, definite sensory loss, or progression (or recurrence) of paralytic disease 1 month or more after onset.

Since 1964, the vaccine-associated cases have not been formally reviewed by the Special Advisory Committee. However, cases have been individually classified by CDC as vaccine-associated on the basis of compatibility with the above criteria and relationship to the underlying disease state (e.g. hypogammaglobulinemia) and available laboratory isolation and serologic results. (See Section III for discussion of laboratory testing.)

Four additional cases of recipient vaccine-associated polio occurred in 1972 (Table 8). One was in an 18-year old male who had a vaccination history of receiving IPV in the 1960s and 1 trivalent oral poliovaccine (TOPV) in 1972. Twelve days after receipt of his second dose of TOPV, he became ill and was left with severe residual at 60 days. Type 3 poliovirus was isolated from the stool, throat, and urine, which was intermediate in its antigenic characteristic and had a +/+ RCT characteristic at 39.2°C and 39.9°C, respectively. These findings were not incompatible with a vaccine strain. In addition, a type 1 poliovirus was isolated from the throat which had a vaccine antigenic characteristic and by RCT characterization, was -/- at 39.2°C and 39.9°C, respectively. This isolate was almost certainly vaccine type.

Table 8

Paralytic Disease in Oral Vaccine Recipients

State	Age	Sex	Date of Onset	Prior		Type Vaccine Administered	Interval to Onset of Symptoms	Isolate		Residual Disability 60 Days
				IPV	OPV			Type	Characteristic*	
Iowa	18 years	Male	10/8/71	1 (1960s)	1 (1972)	TOPV	12 days	1	vaccine -/-	severe
								3	intermediate +/+	
Maine	2 years	Male	5/22/72	0	0	TOPV	2-4 days	2	vaccine -/-	significant
								3	vaccine +/+	
Oregon	9 months	Male	12/31/72	0	1 (10/72)	TOPV	4 days	1	vaccine -/-	significant
								2	wild -/-	
								3	vaccine ±/-	
New York	10 months	Male	5/27/72	0	1 (10/71)	TOPV	75 days	1	wild +/+	death

*Strain characterization by modified wecker serodifferentiation and RCT characteristics

The second case occurred in a 2-year-old male who had no previous vaccination history. He became ill approximately 4 days following receipt of the vaccine. He was left with significant residual at 60 days. Types 2 and 3 polioviruses were isolated from the stool; the type 2 isolate was vaccine-like and the type 3 isolate was not incompatible with a vaccine-like virus.

The third case occurred in a 9-month-old male who had received TOPV 4 days before the onset of symptoms. All 3 poliovirus types were isolated from the stool; types 1 and 3 were vaccine-like and type 2 was found to have an MPB of 41.9 and an RCT of -/-.

The fourth case occurred in a 10-month-old male who had hypogammaglobulinemia. Both the patient and his sibling received TOPV in March 1972. Seventy-five days later, on May 27, 1972, the onset of symptoms began with a respiratory-like illness with progression to coma and death on June 1, 1973. Polio type 1 was isolated from the brain and stool, with an MPB of 43 and an RCT of +/+.

With the addition of these 4 cases, the total number of recipient vaccine-associated polio cases reported to CDC from July 1964 to December 1972 is now 20 cases.

2. Paralytic Poliomyelitis in Contacts of Recent Vaccine Recipients

In addition to the group noted above, it has been recognized that cases of paralytic illness have also occurred in persons with a history of close relationships to OPV recipients. The working definition of a contact vaccine-associated case specifies that onset of illness shall have occurred between 4 and 60 days following feeding of the specific vaccine in question to the recipient in contact with the case, and that the case

shall have had contact with the recipient within 30 days prior to the onset of illness. In addition, criteria b., c., and d. in the definition of a "recipient vaccine-associated" case also applies. This definition of "contact vaccine-association" does not require isolation of a vaccine-like virus from the case. Persons with a vaccine-type poliovirus isolate but with no history of contact are described as "community contact" cases.

Six "contact vaccine-associated" cases were reported for 1972 (Tables 9 and 10). Four of the cases occurred in adults living with children who had received routine TOPV. The remaining 2 cases had polio with a vaccine-type isolate but no known contact with recently immunized persons (Table 10). Four of the 6 cases occurred in persons with no history of prior polio immunization; the other 2 had received only IPV. In 5 of the 6 cases with poliovirus isolated, 3 were type 3 and 2 were type 1.

Table 9

Paralytic Disease in Close Contacts of Vaccine Recipients, 1972

State	Age	Sex	Prior Immuniz	Contact: Relation-ship	Contact: Vaccine Administered	Interval Administered to Onset	PT's Isolate Type	Antigenic and RCT* Characteristic	4-Fold AB Change	Residual Disability
Texas	35	M	0	son	TOPV	51 days	3	Non-Vaccine +/-	1,2,3	death
Florida	21	F	0	baby	TOPV	26 days	3	Vacc-like +/+	3	severe
Georgia	30	M	0	daughter	TOPV	23 days	none	-	no change	significant
Indiana	18	M	1-IPV	nephew	TOPV	48 days	1	Vacc-like -/-	no change	minor

*RCT performed at 39.2°C and 39.9°C

Table 10

Paralytic Disease in "Community Contacts," 1972

State	Age	Sex	Prior Immuniz	Contact: Relation-ship	Contact: Vaccine Administered	Interval Administered to Onset	PT's Isolate Type	Antigenic and RCT* Characteristic	4-Fold AB Change	Residual Disability
Wisconsin	18	F	0	none	unknown	unknown	1	Vacc-like -/-	no change	severe
Texas	12	M	1-IPV	none	unknown	unknown	3	Vaccine -/-	1,2	minor

*RCT performed at 39.2°C and 39.9°C

3. Rates of Vaccine-Associated Paralytic Polio in OPV Recipients and Their Contacts

The experience of recipients and their contacts with respect to developing vaccine-associated paralytic disease can be expressed in terms of rates of cases per million doses of vaccine distributed (Table 11). These statistics provide a useful basis for comparing trends. However, these rates do not accurately reflect the risks to recipients or their contacts because there are no satisfactory estimates of the number of doses actually received or the number of susceptible persons who come in contact with vaccine recipients. These rates are divided into 2 periods, 1961-1964 and 1965-1971. Beginning in 1965, a general curtailing of routine immunizations for adults was recommended by the Advisory Committee on Immunization Practices (ACIP), followed by a shift in emphasis from mass immunization campaigns and community-wide programs to routine immunization of infants; TOPV became the most widely used oral poliovirus vaccine.

Table 11

Rates of Vaccine-Associated Paralytic Polio in Known Recipients and Their Contacts, United States, 1961-1972

Vaccine	Period	Est. Doses Distributed in Millions	Recipient Cases	Recipient Rate/Million	Contact Cases	Contact Rate/Million
MOPV-1	1961-64	109*	16	0.147	0	0
	1965-72	8.76	1	0.114	2	0.228
MOPV-2	1961-64	104*	2	0.019	0	0
	1965-72	6.96	0	0	2	0.287
MOPV-3	1961-64	105*	39	0.371	3	0.029
	1965-72	7.46	6	0.804	0	0
All MOPV	1961-64	318*	57	0.179	3	0.009
	1965-72	23.2	7	0.302	4	0.172
TOPV	1961-64	28.2	5	0.177	0	0
	1965-72	182	8	0.033	38	0.209
All OPV	1961-64	346	62	0.179	3	0.009
	1965-72	205	15	0.063	42**	0.205

*Sources of distribution data: state health departments and PHS regional offices prior to June 1962, and the Biologic Surveillance Unit, CDC, subsequently
**Includes 1 case for which type of vaccine administered to recipient is unknown

As noted in the 1971 Annual Poliomyelitis Surveillance Report, since 1964, there has been a statistically significant decrease in the rate of vaccine-associated cases in vaccine recipients ($p<.0001$) and a statistically significant increase in this rate for contacts of vaccine ($p<.0001$). The theory was proposed that the significant increase in contact cases was due to both the shift in emphasis from mass immunization campaigns to routine immunization of infants, and to a presumed improvement in recognition of contact cases, facilitated by the reduction of the total number of poliomyelitis cases following the 1961-1964 polio immunization campaigns. The contact cases which occurred in 1972 were consistent with this theory since 4 of the 6 unimmunized persons had contact with immunized infants. In the other 2 cases, there was no history of contact with recently immunized persons.

4. Vaccine Failures

A "vaccine failure" is presently defined as paralytic disease attributed to poliovirus infection occurring in an individual having previously received an "adequate immunization series." As defined by the ACIP, an adequate series consists of 4 or more doses of IVP, 3 doses of MOPV plus 1 dose of TOPV, or 3 doses of TOPV at appropriate intervals (see Appendix). Four of the 22 paralytic cases reported for 1972 had received only 1 OPV dosage prior to onset of illness (Table 12). These 4 cases bring to 78 the total number of persons reported since 1963 to have received at least 1 dose of OPV prior to onset of paralytic poliomyelitis. Of the 7 isolates obtained from these 4 patients, 4 were type 1 and 2 were type 3. Sixteen of the 22 patients had received no previous immunization, and 3 of the 22 had received only 1 previous dose of IPV.

Table 12

Paralytic Poliomyelitis by Immunization Status of All Persons With History of at Least 1 Immunization, 1972

State	Age	Sex	Prior TOPV Doses	Year of Last OPV Dose	Prior IPV Doses	Year of Last IVP Dose	Virus Type Implicated	Residual Disability
Texas	12 years	M	0	-	1	1967	3	minor
Virginia	50 years	M	1	1963	0	-	1	minor
New York	10 months	M	1	1971	0	-	1	death
Iowa	18 years	M	1	1972	1	1960	1,3	severe
Indiana	18 years	M	0	-	1	1962	1	minor
Oregon	9 months	M	1	1972	0	-	1,2,3	significant

III. LABORATORY STUDIES OF POLIOMYELITIS

A. Characterization of Poliovirus Isolations

Laboratory techniques have been employed to differentiate "vaccine-like" from "nonvaccine-like" strains of virus isolates. One of these tests, the modified Wecker intratypic serodifferentiation test, is based upon certain antigenic characteristics of the virus strains. Another test, the "temperature marker" ("T" marker) is based upon comparison of viral replication at different temperatures. In general, strains of poliovirus types 1 and 2 that are antigenically "vaccine-like" are usually associated with negative "T" markers, while this association is seen less frequently with poliovirus type 3. These tests can establish the origin of the virus isolated with some degree of probability. However, because certain wild type 3 viruses are antigenically "vaccine-like," and because of the known antigenic and "T" marker changes which can occur, especially with vaccine type 1 virus, these tests do not definitely establish the origin of the virus isolated. Furthermore, these tests do not in any way indicate the neurovirulance of the isolated virus.

Laboratory characterization studies were performed by the Enteric Virology Branch, Bureau of Laboratories, CDC, on 19 isolates from 15 patients with paralytic poliomyelitis reported in 1972 (Table 13).

Table 13

Classification of Isolates by Wild or Vaccine-Associated Disease, 1972

Type	State	Age	Sex	Epidemiologic Data	Polio Virus Type	Antigenic Characteristics	RCT Characteristics 39.2° 39.9°
Wild	Connecticut	16 years	M	(See Section II.D.)	1	Nonvacc-like	+/+
	Massachusetts	18 years	M		1	Nonvacc-like	+/+
	New York	15 years	M		1	Nonvacc-like	+/+
	Connecticut	17 years	M		1	Vacc-like	+/+
	New York	15 years	M		1	Nonvacc-like	+/+
	Connecticut	7 years	F		1	Nonvacc-like	+/+
Vaccine-Associated Recipient	Iowa	18 years	M	Recipient 9/26, onset interval 12 days	1 3	Vaccine intermediate	-/- +/+
	Maine	2 years	M	Recipient dose 2, 5/18, onset interval 4 days	2 3	Vacc-like Vacc-like	+/+ +/+
	New York	10 months	M	Hypogammaglobulinemia recipient 3/72 contact 3/72 onset interval 75 days	1	Nonvacc-like	+/+
Vaccine-Associated Contact	Texas	12 years	M	No contact known	3	Vacc-like	-/-
	Florida	21 years	F	Contact 5 months baby, 26 day onset interval	3	Vacc-like	+/+ -
	Indiana	18 years	M	Nephew, onset interval 48 days	1	Vacc-like	-/-
	Wisconsin	18 years	F	No contact known	1	Vacc-like	-/-
	Texas	35 years	M	4 month son, 5 day onset interval	3	Nonvacc-like	+ -/+
	Oregon	9 months	M	recipient - 4 day interval	1 2 3	Vaccine Wild Vaccine	-/- -/- + -/-

B. Poliovirus Isolations, 1972

Reports of 150 poliovirus isolations were received from state reporting laboratories in 1972. Only 13 (8%) were associated with paralytic disease, whereas 28 (19%) were in persons with aseptic meningitis and/or encephalitis (Table 14). Each of the 3 types were isolated with similar frequency.

Table 14

Poliovirus Isolations, by Type and Clinical History
United States 1972

Clinical History	Type 1	Type 2	Type 3	Total
Associated with Paralytic Disease	7	2	4	13
Associated with Aseptic Meningitis and/or Encephalitis	11	9	8	28
Other	29	30	16	75
Unknown	10	15	9	34
Total	57	56	37	150

C. The 1972 Immunization Survey

A second approach to estimating immunization levels in the population involves a sample survey of the history of types and doses of vaccine received.* While this questionnaire method is not as accurate as serologic surveillance, it has proved useful in assessing the proportion of the population that can be expected to exhibit immunity to poliovirus infection. Table 15 shows the percentage of the population under 15 years of age, by age group, that received at least 3 doses of either OPV or IPV and the percentage that received no poliovaccine whatsoever from 1965-1972.

Table 15

Poliovaccine Immunization Status by Age Group (Under 15 Years)
United States 1965-1972

	Percentage with ≥ 3 doses of OPV or ≥ 3 doses of IPV			Percentage with no OPV or IPV Immunization		
	Age Group			Age Group		
Year	1-4	5-9	10-14	1-4	5-9	10-14
1965	73.9	89.9	92.1	9.9	3.0	2.1
1966	70.2	88.2	90.0	11.3	2.9	2.3
1967	70.9	88.3	89.7	11.7	3.1	2.2
1968	68.3	84.9	87.8	10.5	3.3	2.2
1969	67.7	83.6	85.7	10.2	3.2	2.5
1970	65.9	82.3	85.3	10.8	3.6	2.3
1971	67.3	81.2	83.9	8.6	3.3	2.6
1972	62.9	78.9	81.8	10.7	3.9	3.2

The decline noted from 1965-1970 in the percentage of preschool age children who received at least 3 doses of either OPV or IPV recurred in 1972, following a slight plateau in 1971. A decreasing level in the percentage with adequate immunization occurred in all age groups. The 5-9 and 10-14 year age groups had the highest percentage with no OPV or IPV since 1965, and the percent in the 1-4 year age group also increased over 1971.

IV. VACCINE DISTRIBUTION AND VACCINATION STATUS OF THE POPULATION

Two kinds of information indicative of the vaccination status of the United States population are available. One is the number of doses of poliovaccine distributed annually in the United States. These data, as summarized for 1962-72 in Table 16, present not the number of doses administered, but the maximum possible utilization. More importantly, these data show certain trends in immunization practice. Clearly, TOPV was the only vaccine being utilized in significant quantities in 1972.

*United States Immunization Survey, September 1972

Table 16

Poliomyelitis Vaccines, Net Doses (Millions) Distributed Annually
United States 1962-1972

Poliomyelitis Vaccine	Year										
	1962*	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Inactivated (IPV)	15.3	19.0	8.8	7.5	5.5	4.0	2.7	***	***	***	***
Live, Oral (OPV)											
Monovalent (MOPV)											
Type 1	33.1	38.7	24.9	4.7	1.4	1.3	0.5	0.5	.3	.2	***
Type 2	37.0	34.2	29.8	3.4	1.3	0.9	0.5	0.4	.2	.1	***
Type 3	13.7	54.2	28.4	3.7	1.4	1.0	0.6	0.4	.3	.2	***
Trivalent (TOPV)	---	4.2**	24.0	17.4	24.0	18.0	23.9	22.5	25.8	25.5	24.7
Total	99.1	150.3	115.9	36.7	33.6	25.2	28.2	23.7	26.6	25.9	24.7

*July-December (Biologics Surveillance Program began in July 1962)
**Production began in mid-1962
***Not shown since fewer than 3 distributors reported

V. ADDENDUM - ADDITIONAL CASES OF PARALYTIC POLIOMYELITIS REPORTED FOR 1971

Two additional "contact vaccine-associated" cases occurring in 1971 were reported to CDC following publication of the 1971 Annual Poliomyelitis Surveillance Report. This increases the total to 10 "contact vaccine-associated" cases for 1971, the highest number reported since 1964. The first case was in a 20-year-old female from Indiana with a history of 2 previous doses of IPV and no previous OPV, who came in contact with her recently vaccinated 6-month-old child. The date of onset was 35 days after the vaccination of the child with TOPV. Stool and nasal swabs did not yield an isolate, but there was a rise in titer to type 3 poliovirus.

The second case was in a 29-year-old female from Illinois with no previous immunization history, who came into contact with her recently vaccinated infant. Onset of illness was 19 days following the child's immunization with TOPV; the mother was left with minor residual at 60 days. No isolate was obtained from the mother, and a serologic rise to type 2 occurred.

JUNE 1972

RECOMMENDATION OF THE PUBLIC HEALTH SERVICE ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES

POLIOMYELITIS VACCINE

INTRODUCTION

Widespread use of poliovirus vaccines since 1955 has resulted in the virtual elimination of paralytic poliomyelitis in the United States. To ensure continued freedom from the disease, it is necessary to pursue regular immunization of all children from early infancy.

Paralytic poliomyelitis declined from 18,308 cases in 1954 to 32 cases in 1970 and 19 cases in 1971. A national survey in 1971 showed that 77 percent of individuals 1–19 years old had received at least 3 doses of oral poliovirus vaccine*(OPV), inactivated poliovirus vaccine**(IPV), or both.

Nevertheless, low immunization rates still prevail in certain disadvantaged urban and rural groups, particularly for infants and young children born since the mass immunization campaigns conducted between 1958 and 1962. Most of the cases of paralytic poliomyelitis in recent years occurred in these populations.

With widespread use of poliovirus vaccine, laboratory surveillance of enteroviruses indicates that circulation of wild polioviruses has diminished markedly. It can be assumed that inapparent infections with wild strains will no longer contribute significantly to maintaining immunity; therefore, it is essential not only to continue active immunization programs for infants and children but also to make special efforts to raise the low immunization rates existing in certain other segments of the population.

POLIOVIRUS VACCINES

Between 1955, when IPV was introduced, and 1962, when live, attenuated vaccines became widely used, more than 400 million doses of IPV were distributed in the United States. Primary immunization with IPV plus regular booster doses provided a high degree of protection against paralytic disease.

OPV has almost completely replaced IPV in this country because it is easier to administer and produces an immune response like that induced by natural poliovirus infection.

Monovalent OPV types 1, 2, and 3 were widely used in the United States beginning in 1961, but they have generally been supplanted by trivalent OPV because of greater simplicity in scheduling and recordkeeping.

A primary series of 3 adequately spaced doses of trivalent OPV will produce an immune response to the 3 poliovirus types in well over 90 percent of recipients.

Very rarely, paralysis has occurred in recipients of OPV or in their close contacts within 2 months of its administration. During 1963-70, about 147 million doses of trivalent OPV were distributed in the United States. In the same 8-year period, 9 cases of "vaccine-associated" paralysis in recipients (0.06/million doses distributed) and 21 in contacts of recipients (0.14/million doses distributed) were reported.

In 1972, OPV produced in the WI-38 strain of human diploid cells was licensed in the United States. This vaccine is considered to be equivalent in safety and effectiveness to vaccine produced in primary rhesus monkey kidney cell culture.

VACCINE USAGE

Trivalent OPV—Primary Immunization

Infants: The 3-dose immunization series should be started at 6–12 weeks of age, commonly with the first dose of DTP. The second dose should be given not less than 6 and preferably 8 weeks later. The third dose is an integral part of primary immunization and should be administered 8–12 months after the second dose.

Children and adolescents: For unimmunized children and adolescents through high school age, the primary series is 3 doses. The first 2 should be given 6–8 weeks apart, and the third, 8–12 months after the second. If circumstances do not permit the optimal interval between the second and third doses, the third may be given as early as 6 weeks after the second.

Adults: Routine poliomyelitis immunization for adults residing in the continental United States is not necessary because of the extreme unlikelihood of exposure. However, an unimmunized adult at increased risk through contact with a known case or travel to areas where polio is epidemic or occurs regularly should receive trivalent OPV as indicated for children and adolescents. Persons employed in hospitals, medical laboratories, and sanitation facilities might also be at increased risk, especially if poliomyelitis is occurring in the area.

Pregnancy is not an indication for vaccine administration, nor is it a contraindication when protection is required.

Monovalent OPV—Primary Immunization

An alternative primary immunization is 1 dose of each of the 3 types of **monovalent** OPV given at 6–8 week intervals. A dose of **trivalent** OPV should be given

*Official names: (1) Poliovirus Vaccine, Live, Oral, Type 1, (2) Poliovirus Vaccine, Live, Oral, Type 2, (3) Poliovirus Vaccine, Live, Oral, Type 3, (4) Poliovirus Vaccine, Live, Oral, Trivalent.

**Official name: Poliomyelitis Vaccine.

8-12 months after the third dose of monovalent OPV to ensure adequate responses to all poliovirus types.

OPV–Booster Doses

Entering school: On entering kindergarten or first grade, all children who have completed the primary series of OPV should be given a single dose of trivalent OPV; others should complete the primary series.

There is no indication for routine booster doses of OPV beyond that given at the time of entering school.

Increased risk: A single dose of trivalent OPV can be administered to anyone who has completed the full primary series because of travel or occupational hazard as described above. The need for such an additional dose has not been established, but if there is uncertainty about the adequacy of existing protection, a single dose of trivalent OPV should be given.

Contraindications

Altered immune states: Infection with live, attenuated polioviruses might be potentiated by severe underlying diseases, such as leukemia, lymphoma, or generalized malignancy, or by lowered resistance, such as from therapy with steroids, alkylating drugs, antimetabolites, or radiation; therefore, vaccination of such patients should be avoided.

EPIDEMIC CONTROL

For operational purposes in the United States, an "epidemic" of poliomyelitis is defined as 2 or more cases caused by the same poliovirus type and occurring within a 4-week period in a circumscribed population, such as that of a city, county, or a metropolitan area. An epidemic can be controlled with either trivalent OPV, or, after identification of the responsible type of poliovirus, homotypic monovalent OPV. Within the epidemic area, all persons over 6 weeks of age who have not been completely immunized or whose immunization status is unknown should promptly receive OPV.

SIMULTANEOUS ADMINISTRATION OF LIVE VIRUS VACCINES

There are obvious practical advantages to administering 2 or more live virus vaccines simultaneously. Data from specific investigations are not yet sufficient to develop comprehensive recommendations on simultaneous use, but a summary of current experience, attitudes, and practices provides useful guidance.

It has been generally recommended that live virus vaccines be given at least 1 month apart whenever possible–the rationale for this being that more frequent and severe adverse reactions as well as diminished antibody responses otherwise might result. Field observations indicate, however, that with simultaneous administration of certain live virus vaccines, results of this type have been minimal or absent.

If the theoretically desirable 1-month interval is not feasible, as with the threat of concurrent exposures or disruption of immunization programs, the vaccines should preferably be given on the same day–at different sites for parenteral products. An interval of about 2 days to 2 weeks should be avoided because interference between the vaccine viruses is most likely then.

Published: Supplement to the Poliomyelitis Surveillance Unit Report No. 285, 1964; revised MMWR Vol 16 No. 33, 1967; revised Vol 18 No. 43-Supp 1969; revised Vol 21 No. 25-Supp 1972.

SELECTED BIBLIOGRAPHY

Center for Disease Control: Annual Poliomyelitis Summary 1969. 15 June 1970; Annual Poliomyelitis Summary – 1970. 30 Sept 1971

Evidence on the safety and efficacy of live poliomyelitis vaccines currently in use, with special references to type 3 poliovirus. Bull WHO 42:925-945, 1970

Hardy GE, Hopkins CC, Linnemann CC Jr, et al: Trivalent oral poliovirus vaccine: A comparison of two infant immunization schedules. Pediatrics 45: No. 3, Part 1, 1970

Henderson DA, Witte JJ, Morris L, et al: Paralytic disease associated with oral polio vaccines. JAMA 190:41-48, 1964

Hopkins CC, Dismukes WE, Glick TH, et al: Surveillance of paralytic poliomyelitis in the United States. JAMA 210:694-700, 1969

Horstmann DM: Enterovirus infections of the central nervous system. The present and future of poliomyelitis. Med Clin North Am 51:681-692, 1967

Report of Special Advisory Committee on Oral Poliomyelitis Vaccines to the Surgeon General of the Public Health Service: Oral poliomyelitis vaccines. JAMA 190:49-51, 1964

Sabin AB: Commentary on report on oral poliomyelitis vaccines. JAMA 190:52-55, 1964

Wehrle PF: Immunization against poliomyelitis. Arch Environ Health 15:485-490, 1967

STATE EPIDEMIOLOGISTS

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, interpretation and transmission of data and epidemiologic information from their individual States, the State epidemiologists perform a most vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

Alabama	Frederick S. Wolf, M.D.
Alaska	Donald K. Freedman, M.D.
Arizona	Philip M. Hotchkiss, D.V.M.
Arkansas	Andrew G. Dean, M.D., Acting
California	James Chin, M.D.
Colorado	Thomas M. Vernon, Jr., M.D.
Connecticut	James C. Hart, M.D.
Delaware	Ernest S. Tierkel, V.M.D.
District of Columbia	Samuel Khoury, M.D., Acting
Florida	Chester L. Nayfield, M.D.
Georgia	John E. McCroan, Ph.D.
Hawaii	Ned Wiebenga, M.D.
Idaho	John A. Mather, M.D.
Illinois	Byron J. Francis, M.D.
Indiana	Charles L. Barrett, M.D.
Iowa	Charles A. Herron, M.D.
Kansas	Don E. Wilcox, M.D.
Kentucky	Calixto Hernandez, M.D.
Louisiana	Charles T. Caraway, D.V.M.
Maine	Peter J. Leadley, M.D.
Maryland	Anita Bahn, M.D.
Massachusetts	Nicholas J. Fiumara, M.D.
Michigan	Norman S. Hayner, M.D.
Minnesota	D. S. Fleming, M.D.
Mississippi	Durward L. Blakey, M.D.
Missouri	H. Denny Donnell, Jr., M.D.
Montana	Martin D. Skinner, M.D.
Nebraska	Paul A. Stoesz, M.D.
Nevada	William M. Edwards, M.D.
New Hampshire	Vladas Kaupas, M.D.
New Jersey	Ronald Altman, M.D.
New Mexico	Charles F. von Reyn, M.D., Acting
New York State	Donald O. Lyman, M.D., Acting
New York City	Pascal J. Imperato, M.D.
North Carolina	Martin P. Hines, D.V.M.
North Dakota	Kenneth Mosser
Ohio	John H. Ackerman, M.D.
Oklahoma	Stanley Ferguson, Ph.D.
Oregon	John A. Googins, M.D.
Pennsylvania	W. D. Schrack, Jr., M.D.
Puerto Rico	Angel M. Ayala, M.D.
Rhode Island	Michael P. Hudgins, M.D., Acting
South Carolina	William B. Gamble, M.D.
South Dakota	Robert S. Westaby, M.D.
Tennessee	Robert H. Hutcheson, Jr., M.D.
Texas	M. S. Dickerson, M.D.
Utah	Taira Fukushima, M.D.
Vermont	Geoffrey Smith, M.D.
Virginia	Robert S. Jackson, M.D.
Washington	Thieu Nghiem, M.D.
West Virginia	N. H. Dyer, M.D.
Wisconsin	H. Grant Skinner, M.D.
Wyoming	Herman S. Parish, M.D.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HEW
HEW 399

DHEW Publication No. (CDC) 75-8214